

**DEVELOPING A FIREFIGHTER WELLNESS/FITNESS
PROGRAM FOR THE SCHENECTADY FIRE DEPARTMENT**

EXECUTIVE DEVELOPMENT

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Abstract

In 1996, the Schenectady Fire Department (SFD) experienced the line-of-duty death of a firefighter due to a heart attack. Between 1990 and 2003, seven SFD suffered heart attacks while off-duty, with one firefighter becoming permanently disabled. Another SFD firefighter underwent emergency coronary artery by-pass surgery early in 2003, and also faces the prospect of permanent disability. The problem was that the SFD had no wellness/fitness program for its members, and no consideration had been given to the establishment of such a program.

Action research was conducted to answer the following questions:

1. Are there any National or State standards for physical fitness/wellness that are applicable to the Schenectady Fire Department?
2. Are there existing programs that can be examined in the development of a fitness/wellness program for the Schenectady Fire Department?
3. What are the benefits that a fitness/wellness program would provide to the members of the Schenectady Fire Department?
4. What wellness/fitness program would be appropriate and accepted by SFD members?

The procedures used to conduct this research included a literature review of National Fire Protection Association (NFPA) standards 1582 and 1583, a review of health-related initiatives from the International Association of Fire Fighters (IAFF), literature from the American Heart Association (AHA), and the National Fire Academy (NFA). A convenience survey of SFD members was conducted to determine interest and preferences in a wellness/fitness program. Personal

interviews were conducted with SFD Chief Robert Farstad, and with Judd Harrington, MD, Medical Director of the Ellis Hospital Center for Occupational Medicine.

Research indicates that SFD should immediately institute a wellness/fitness program for its members. The model program in NFPA 1583 offers all components suggested by this research.

Recommendations made as a result of this research included: SFD should continue its practice of requiring yearly physical examinations of all members. SFD should institute a wellness/fitness program for all members, based on the model program in NFPA 1583. SFD should establish an ergonomics committee, and allow this committee to examine and recommend items such as equipment, turnout gear, uniforms, and uniform shoes. SFD should explore monetary incentives for meeting physical fitness standards.

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Introduction

The Schenectady Fire Department (SFD) currently employs 120 sworn personnel in an all career department. SFD provides the City of Schenectady with fire protection and emergency medical services (EMS) at the Paramedic level. The City of Schenectady has experienced many of the same problems as many northeastern cities, namely a loss of its industry to Sun Belt states and overseas facilities. As the both population and tax base have shrunk, so has the fire department's staffing. SFD staffing has declined steadily for the last thirty years, from a high of 288 career personnel in the 1960's, to the current level of 120. As staffing has declined, the workload has grown considerably. In 1980, SFD responded to 2,386 calls. In 2002, SFD responded to 11,140 calls. Each SFD member must perform a larger workload now than at any time in the history of the department. Between 1990 and 2003, SFD had 1 line-of-duty death (1996) due to a heart attack, and seven members who had heart attacks while off-duty, ranging in seriousness from mild to severe. The member who suffered the severe heart attack was unable to return to full duty, and was placed in a light-duty assignment. In 2003, another member underwent emergency coronary by-pass surgery, and his return to work status remains uncertain.

SFD also currently has 7 members on injured leave, with a variety of injuries. One member suffered a potentially career-ending ruptured Achilles' tendon in August 2002, and is still unable to return to work. A second member's back injury may necessitate surgery, and may result in permanent disability. During 2002, 14 SFD firefighters were transported to hospitals for heat exhaustion related to exertion at structure fires.

According to the National Fire Protection Association (NFPA), excluding the tragic loss of 343 Firefighters in the attacks on the World Trade Center, the leading cause of death was “overexertion or stress that led to on-the-job heart attacks” (www.nfpa.org). The NFPA notes that there were 99 firefighter deaths in 2002 unrelated to the World Trade Center attacks, and that 40 of these deaths were from heart attacks. Heart attacks have consistently been the leading killer of firefighters for many years (www.nfpa.org). The mental and physical stresses placed on firefighters have caused more deaths due to heart attacks than from any other cause. Many of the improvements in encapsulating protective gear design have also increased heat stress on firefighters. The unavoidable stresses of firefighting have led many organizations, such as the International Association of Firefighters (IAFF), to recommend that local departments implement wellness and/or fitness programs (IAFF, 1997).

The problem this paper addresses is the Schenectady Fire Department currently has no wellness/fitness program. The development of wellness/fitness program is an attempt to prevent the injury or heart attack of an SFD member due to exertion or stress. This is viewed as a problem due to the line-of-duty death of an SFD member, the heart attacks suffered by 7 SFD members in the last 10 years, and the on duty injuries incurred while members were operating at fires. While the Schenectady Fire Department currently requires yearly physical examinations, which conform to Occupational Safety and Health Administration (OSHA) standards, there are no educational programs to address nutrition, stress reduction or physical conditioning.

The purpose of this applied research project was to address the following research questions:

- Are there any National or State standards for physical fitness/wellness that are applicable to the Schenectady Fire Department?
- Are there existing programs that can be examined in the development of a fitness/wellness program for the Schenectady Fire Department?
- What are the benefits that a fitness/wellness program would provide to the members of the Schenectady Fire Department?
- What wellness/fitness program would be appropriate and accepted by SFD members?

Action research was used to answer these questions, and design a wellness/fitness program for SFD. A literature review of available research pertaining to both wellness and fitness programs was done. The State University of New York (SUNY) at Albany's Library was used, as was the Learning Resource Center (LRC) of the National Fire Academy (NFA). The NFPA's website was also utilized. Interviews of SFD's Chief, Robert Farstad, and the medical director of Ellis Hospital's Occupational Health Center, Dr. Judd Harrington, were conducted, and SFD members were surveyed on their opinions regarding a wellness/fitness program.

Background & Significance

The Schenectady Fire Department is located in Schenectady County, New York, approximately 15 miles west of the state capitol of Albany. The Fire Department consists of 120 career personnel. Currently, daily on-duty staffing fluctuates between 15 and 20. SFD provides fire suppression and EMS with a daily minimum of 4 Advanced Life Support (ALS) engine companies, and 2 Basic Life Support (BLS) truck companies. Both engine and truck companies are typically staffed by 3 members. If staffing levels permit, 2 ALS Rescue Units are also placed in service, each with a crew of 2. SFD provides fire protection and EMS for a city of 62,000 (2000 Federal Census). SFD members work a 24-hour shift, followed by 72 hours off-duty.

SFD began Paramedic level care in 1980, and EMS calls have steadily increased each year. In 1980, SFD responded to 2,386 calls, with the total number of calls increasing to 11,140 in 2002. EMS calls accounted for 8,765 (78%) of the 2002 call totals. This increase in workload has coincided with a reduction in daily staffing. In 1990, SFD's authorized strength was 155, with 3 ALS Rescues, 6 BLS Engines, and 2 Truck companies. Daily minimum staffing was 30, and staffing vacancies were filled by utilizing overtime personnel. During the early to mid 1990's, Schenectady experienced several years of budget deficits, which led to fire staffing reductions, and the lay-off of 19 firefighters on January 1, 1996. Four months later, SFD had a line-of duty death, due to a heart attack sustained while operating at the scene of a structure fire.

Staffing has gradually been eroded to an unofficial daily minimum of 16, which allows the staffing of 4 engines and 2 trucks, and 1 rescue. Under the current policy, if a member is ill, or takes time off, no replacement is hired until staffing reaches the

unofficial minimum of 18. As staffing levels fall, the rescue units are temporarily removed from service, which has led to feelings of frustration and stress by SFD personnel. Many SFD members have expressed frustration that they may begin their shift at 0800 hours on Rescue #1, and then be “jumped” to another station of apparatus due to another member’s illness or time off. This “jumping” has created a new term, “round-robin”, which is used when a firefighter is forced to jump to all four SFD fire stations in the course of one 24-hour shift. This frustration adds to the stress these firefighters must deal with daily.

This applied research project relates to one the United States Fire Administration’s (USFA) operational goals to “reduce the loss of life from fire of firefighters” (Executive Fire Officer Program, Applied Research Guidelines, 2002). This research also relates to the NFA’s Executive Development course goal to "lead effectively and efficiently within a dynamic and complex organization by enhancing development of teams and application of action research" (SM 0-3). The use of action research to develop a wellness/fitness program relates to Unit 7: Organizational Culture (SM 7-3). In order to be successful, a wellness/fitness program must change the culture of SFD by challenging the assumptions that some members have regarding such a program.

Literature Review

Since heart attacks account for the majority of firefighter deaths (www.nfpa.org), literature review began with the topic of heart disease. Each year, approximately 1.5 million US residents experience a heart attack; also known as Acute Myocardial Infarction (AMI) (Stapelton, ed. et al, 2001). About 1 million will die, and 50 percent of the patients experiencing an AMI will die suddenly, within the first hour of the onset of symptoms (Stapelton, ed. et al, 2001). According to the American Heart Association (AHA), each year about 960,000 Americans die from heart attacks or strokes, and over 60 million have some type of heart or blood vessel disease (www.americanheart.org). An AMI occurs when a coronary artery becomes blocked by either atherosclerosis or a blood clot. Coronary arteries supply oxygenated blood to heart muscle, also called myocardium. Arteriosclerosis or “hardening of the arteries” is one cause of atherosclerosis. Arteriosclerosis can lead to the build-up of fatty deposits in arteries, causing narrowing of these vessels, which can cause a decrease in the flow of blood to the heart (Stapelton, ed. et al, 2001).

The American Heart Association states that, there are risk factors for heart disease that cannot be changed, such as heredity, a family history of heart disease. Gender is another factor, with pre-menopausal women having a lower incidence of heart disease than men. Race is another factor, which cannot be changed, with African-Americans suffering twice the risk of whites (Stapelton, ed. et al, 2001. p. 50).

There are several risk factors that can be changed, with tobacco use causing “1 in 5 deaths from cardiovascular disease” (Stapelton, ed. et al, 2001, p. 50). High blood pressure, also called hypertension, is another modifiable risk factor for heart disease.

Elevated blood cholesterol levels can also increase the risk of heart disease. Using diet and exercise can sometimes lower cholesterol, which is the fat-like component of atherosclerotic deposits. Medications are also available to assist in the control of cholesterol levels. Lack of physical exercise, obesity, control of diabetes, and stress are also modifiable risk factors (Stapelton, ed. et al, 2001, pp. 50-55).

NFPA 1583, Standard on Health-Related Fitness Programs for Fire Fighters, addresses modifiable risk factors by shifting the focus from protective equipment, clothing, and apparatus to firefighter health. According to the NFPA, “overweight, out-of-shape fire fighters are an accident waiting to happen” (1583-1). NFPA 1583 recommends the creation of a Health and Fitness Coordinator (HFC), who acts as the liaison between the department physician and the department. The HFC would also conduct yearly fitness assessments of all members and be responsible for administering an exercise and fitness program with the following components:

- (1) An educational program that describes the components and benefits of exercise, fitness, fitness training, and weight management.
- (2) An individualized exercise prescription based on the results of the fitness assessment
- (3) Warm-up and cool-down exercise guidelines
- (4) Aerobic exercise program
- (5) Muscular (strength, endurance) exercise program
- (6) Flexibility exercise program
- (7) Healthy back exercise program

(8) Safety and injury prevention program

(NFPA 1583, 5.1, 2000)

The HFC is responsible for ensuring the availability of certain recommended exercise equipment, such as a treadmill, stair climber, stationary bike, free weights, and weight lifting equipment. NFPA 1583 allows departments to utilize either purchased or donated equipment, to manufacture some of the items, or to contract with health clubs, schools or other institutions for the use of their fitness facilities. The HFC may be a qualified member of the department, or may be an outside contractor hired to administer a fitness program (NFPA 1583, 3.1, 2000).

NFPA 1582, Standard on Medical Requirements for Fire Fighters and Information for Fire Department Physicians (2000) also addresses the issue of firefighter fitness. NFPA 1582 recommends that each member undergo an annual medical evaluation consisting of:

- (1) An interval medical history
- (2) An interval occupational history, including significant exposures
- (3) Height and weight
- (4) Blood pressure
- (5) Heart rate and rhythm

(NFPA 1582, 2-4.1.2, 2000)

NFPA 1582 also recommends that members age 29 and under have a complete medical examination at least every 3 years, that members ages 30 to 39 have an examination at least every 2 years, and that members ages 40 and over have a complete physical examination every year (NFPA 1582, 2-4.1.3, 2000). Components of the examination

would include: vital signs, dermatological system, ears, nose, throat, mouth, cardiovascular system, respiratory system, and gastrointestinal system. The examination would also cover genitourinary, endocrine, metabolic, musculoskeletal, and neurological systems. Hearing and vision are also checked, a pulmonary function test (PFT) is done, and if indicated, further lab testing may be done, as may diagnostic imaging or electrocardiography (NFPA 1582, 2-4.1.4, 2000).

NFPA 1582 also stipulates categories of medical conditions that may affect a member's ability to perform their duties without restriction. These Category A or B conditions are clearly identified, and explanations are provided detailing the reasons for a medical conditions inclusion in either category. Category A conditions are those which "would preclude a person from performing as a member in a training or emergency operational environment by presenting a significant risk to the safety and health of the person or others" (NFPA 1582, 1-4.4, 2000). Those members with a Category B medical condition are those conditions "that based on its severity or degree, could preclude a person from performing as a member in a training or emergency operational environment by presenting a significant risk to the safety and health of the person or others" (NFPA 1582, 1-4.5, 2000).

Literature reviewed for this research paper also included the Federal Emergency Management Agency (FEMA) publication "Fire and Emergency Medical Services Ergonomics" (1996). Ergonomics is "the practice of making the work environment safer and more productive for the worker" (FEMA, p. 1-3, 1996). Firefighting involves many of what FEMA defines as workplace ergonomic risks; forceful exertions, awkward posture, localized contact stress, vibration, environmental stress, and repetitive/prolonged

activity (1-3, 1996). According to FEMA “fire fighters are more likely to receive sprains, strains, and other muscular pain injuries than other types of injuries (p. 1-1, 1996). Also included in FEMA’s manual is a sample fitness evaluation used by the Phoenix Fire Department, which examines 6 areas of fitness; flexibility, muscular power, muscular endurance, muscular strength, body composition, and aerobic capacity (p. D-3, 1996).

The IAFF “Recognition and Prevention of Occupational Heart Diseases” (2001) states, “multiple studies have demonstrated that fire fighters have an increased risk of death due to heart disease (p. 39). The IAFF also notes that “while aging is not reversible, the lifestyle choices that we make are, and can dramatically reduce the risk of atherosclerotic heart disease (ASCVD” (p. 39). Clearly, the IAFF’s recommends that firefighters try to modify those risk factors that can be controlled, through exercise, diet, and healthy lifestyle choices.

Procedures

This research project used action research to study wellness/fitness programs, standards, and educational issues necessary to implement a wellness/fitness program. This research included a literary review, looked at past research projects, and also involved personal interviews with both the Chief of SFD and the Medical Director of Ellis Hospital’s Occupational Medicine Center.

Literature review began at the Learning Resource Center of the National Fire Academy, December 2002. Further research was conducted at the library of State University of New York at Albany, and the American Heart Association web site. The

International Association of Firefighters, Federal Emergency Management Agency, and the National Fire Protection Association were also consulted.

A convenience survey of 32 Schenectady Fire members was conducted, with 8 members on each of SFD's 4 shifts (2 surveys at each at SFD's 4 stations) being surveyed (Appendix B). Each Platoon Commander was asked to distribute 2 survey forms at random to members at each SFD station when their platoon was on duty (Appendix A). The surveys were conducted over a four-day period from May 1, 2003 to May 4, 2003. Of the 32 surveys distributed, 27 were returned (84%).

Results

On question #1; *Are there any National or State standards for physical fitness/wellness that are applicable to the Schenectady Fire Department?*

Both NFPA 1582 and NFPA 1583 contain standards for firefighter physical fitness and wellness. The IAFF's Wellness-Fitness Initiative also offers standards for assessing fitness, and offers suggestions for a physical conditioning program.

On question #2; *Are there existing programs that can be examined in the development of a fitness/wellness program for the Schenectady Fire Department?*

Either the IAFF Wellness-Fitness Initiative or the model program contained in NFPA 1583 would seem ideal for adoption by SFD. Both programs address not only medical screening and fitness conditioning topics, but also wellness topics, such as stress management.

On question #3; *What are the benefits that a fitness/wellness program would provide to the members of the Schenectady Fire Department?*

A Wellness/Fitness program would offer both short and long range benefits to members of SFD. A short-range benefit for members would be a decrease in the time necessary to recover from the physical exertion of firefighting. As each member's physical conditioning improves, they can expect a decrease in resting pulse rates, blood pressure, and a corresponding increase in the efficiency of their cardiovascular systems. These improvements will also translate into fewer injuries, less sick time, and a better quality of life. The long-range benefits may include a longer healthier life, and a decrease in the likelihood of their developing heart disease or cancer.

On question #4, *What wellness/fitness program would be appropriate and accepted by SFD members?*

A convenience survey of 32 Schenectady Fire members was conducted, with 8 members on each of SFD's 4 shifts (2 surveys at each at SFD's 4 stations) being surveyed. Each Platoon Commander was asked to distribute 2 survey forms at random to members at each SFD station when their platoon was on duty Appendix A). The surveys were distributed by platoon commanders to all 4 of SFD's platoons over a four-day period from May 1, 2003 to May 4, 2003 (Appendix B). Of the 32 surveys distributed, 27 were returned. The survey asked the following questions:

(1) Do you think the Schenectady Fire Department should have a Wellness/Fitness Program?

Yes (22) **81%** No (5) **19%**

(2) If you answered yes to Question #1, do you think a Wellness/Fitness Program should be mandatory?

Yes (9) **40%** No (13) **60%**

(3) If a Wellness/Fitness Program included bonuses, either in cash or time off for achieving age-based fitness goals, would you participate?

Yes (24) **88%** No (3) **12%**

(4) Would you be interested in receiving training/education on any of the following? (Circle all that you are interested in)

Strength Training (22) **81%** Aerobic Conditioning (24) **88%**

Nutrition (14) **51%** Stress Reduction (20) **74%**

Smoking Cessation (6) **22%** Drug/Alcohol Abuse (3) **11%**

Injury Prevention (18) **66%** Other_____

Eighty percent of the respondents to the survey were clear that they believed SFD should offer a wellness/fitness program. As expected, only 40 percent thought that such a program should be mandatory. Eighty-eight percent indicated they would be willing to participate in a wellness/fitness program that included bonuses in either cash or time-off for achieving age-based fitness goals. In general, a majority of survey respondents indicated interest in receiving education or training in the areas of strength training, 81 percent, Aerobic conditioning, 88%, nutrition, 51%, stress reduction, 74%, and injury prevention, 66%. Only 22% indicated interest in a smoking cessation program, it is unknown how many of the respondents smoke. Only 11 percent indicated interest in drug/alcohol abuse education, SFD does currently offer an Employee Assistance Program (EAP) that provides confidential assistance to members with drug or alcohol abuse problems.

In general, SFD members view change with suspicion. Decades of declines in staffing, the closure of fire stations, and the lay-off of 19 firefighters in 1996 have left many firefighters with distrust of management. Yet the results of the convenience survey seem to indicate interest in a wellness/fitness program. The model programs that the IAFF offers and the program within NFPA 1583 (Appendix C) contains would seem to be an ideal beginning for a wellness/fitness program. As SFD has for many years required yearly physical examinations for all members, the medical screening suggested by the IAFF Initiative and the screening component of NFPA 1583 already exists. SFD is fortunate to have a firefighter with a Bachelor's degree in Physical Education, who is certified as a Physical Education teacher, and is willing to serve as HFC. All SFD stations have sufficient exercise and weight equipment to comply with NFPA 1583, so there would be no initial equipment expense incurred by the City. A committee made up of members of SFD Local 28 and SFD management may ensure the success of a program.

Discussion

SFD had a member die in the line of duty from a heart attack in 1996, and has had 1 member permanently disabled due to a heart attack in 1998. A second SFD member's status remains uncertain following emergency cardiac by-pass surgery in 2003. A back injury threatens the career of a third SFD member, and a ruptured Achilles' tendon may end the career of a fourth SFD firefighter. These facts have provided the impetus for both SFD's management and labor union to consider the establishment of a wellness/fitness program.

The findings of this research paper indicate that SFD should create a committee of both labor and management to establish a wellness/fitness committee (IAFF, 1997). This research further indicates a labor management partnership in the area of ergonomics is necessary as well (FEMA, 1996). The advantages to labor are healthier, happier members, who will have tangible improvements in their physical and emotional states. Labor will have a voice in selection of equipment such as turn-out gear (FEMA, 1996), and input in the establishment of a wellness/fitness program (IAFF, 1997).

For any program to succeed, both management and labor must strive to change the culture of SFD (Executive Development, 1998, SM 7-3). In the past, many SFD members would work to extinguish a structure fire, then go outside to rehab area and light up a cigarette. Many of our younger members chew tobacco, and alcohol and substance abuse may be a problem for some members. A cultural change will only occur with the concurrence of both labor and management (Executive Development, 1998, SM 7-3).

Recommendations

1. The SFD should continue its practice of requiring yearly physical examinations of all members. These examinations cover all areas in NFPA 1582.
2. The SFD should institute a wellness/fitness program for all members, based on the model program in NFPA 1583. This program should offer all components suggested by NFPA 1583. Since all SFD stations are equipped with the gym equipment NFPA 1583 suggests, implementation should not pose a financial hardship for the City.

3. SFD should establish an ergonomics committee, and allow this committee to examine and recommend items such as equipment, turnout gear, uniforms, and uniform shoes.
4. SFD should explore monetary incentives for meeting physical fitness standards. Such incentives would help overcome the resistance to change that SFD members may have. These incentives would also be part of the non-punitive aspect of the wellness/fitness program that NFPA 1583 suggests.

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APPENDIX A**(Letterhead)**

TO: Platoon Deputy Chiefs
FROM: Captain Scott Doherty
DATE: May 1, 2003
RE: Wellness/Fitness Program

I am currently designing a Wellness/Fitness Program for the Schenectady Fire Department. The purpose of this program would be to improve the overall health of our members, and help reduce stress, injuries and illness.

Many of the proposed components would benefit our members, both at work and at home. Attached are 8 confidential, anonymous survey forms, which I would ask you to distribute to 8 members of your Platoon.

Please deliver a survey form to 2 members at each station. Please select the members randomly at each station. You should give out a total of 8 forms per platoon. Ask the members to fill out the survey form, and return it to me ASAP.

Thank you for your assistance!

APPENDIX B

(Letterhead)

Schenectady Fire Department Wellness/Fitness Program Survey

1. Do you think the Schenectady Fire Department should have a Wellness/Fitness Program?
(circle answer) yes no
comments:

 2. If you answered yes to Question #1, do you think a Wellness/Fitness Program should be mandatory?
(circle answer) yes no
comments:

 3. If a Wellness/Fitness Program included bonuses, either in cash or time off, for achieving fitness goals, would you participate?
(circle answer) yes no
comments:

 4. Would you be interested in receiving training/education on any of the following?
(Circle all that you are interested in)
- | | | |
|-------------------|----------------------|--------------------|
| Strength Training | Aerobic Conditioning | Nutrition |
| Stress Reduction | Smoking Cessation | Drug/Alcohol Abuse |
| Injury Prevention | Other_____ | |
- comments:

Thank you for your participation in this survey! All replies are confidential, and will be used to assist me in designing a program to best serve our members. List any additional comments/concerns in the comment sections, or on the back of this form. Please return this survey to me via your Deputy Chief.

Captain Doherty

APPENDIX C RECOMMENDED FITNESS PROGRAM

Sample HRFP form showing demographic and assessment information.

Right hand kg

Left hand kg

Date of submission (*mm/dd/yy*): Age: Gender: . Male . Female

Fire department confidential identification code:

Fire-fighter confidential identification code number:

Ethnicity: . African American . Asian . Hispanic . Native American . Filipino

. Caucasian . Other

Job assignment: . Structural fire fighting . Administrative officer . Field officer

No. of years in service:

Smoking/Tobacco usage (*packs per day*): . <1 pack . 1 pack . 2 packs . 3 or more packs .

None

Height (*in whole inches*):

Weight (*in whole pounds*):

Personal and Demographic Information

Muscular Strength

. Grip strength test

(One repetition maximum)

. Other

Flexibility

. Trunk flexion (sit and reach test)

. Other Most distal point reached

Fitness Assessment

Mode of Testing Results

Aerobic Capacity

. 1.5 mile walk/run (field test)

. Other

. Step test

Test duration

Step height

. Other

. Submaximal treadmill test

. Other

. Submaximal cycle ergometer test

. Other

Pre-exercise heart rate

Pre-exercise blood pressure

Completed in min sec

VO2 max

Heart rate Blood pressure

Heart rate Blood pressure

Post-exercise heart rate

Post-exercise blood pressure

(NFPA 1583, 1 of 2)

HEALTH-RELATED FITNESS PROGRAMS FOR FIRE FIGHTERS

Sample Fitness Plan

Components and Benefits of Fitness.

The health-related components of fitness focus on the importance of maintaining and increasing an individual's fitness levels, creating positive lifestyle changes, and enhancing job performance. The motorrelated components of fitness improve an individual's athletic endeavors or area(s) of motor performance. Health-related and motor-related components of fitness include the following:

(1) Health-related components of fitness

a. Aerobic capacity

b. Muscular strength

c. Muscular endurance

d. Flexibility

e. Body composition

(2) Motor-related components of fitness

a. Coordination

b. Agility

c. Power

d. Balance

e. Speed

f. Accuracy

Individualized Exercise Prescription Based on the Fitness

Assessment. The components of a basic exercise prescription should include the following:

(1) *Mode*: type of exercise

(2) *Intensity*: difficulty of the exercise

(3) *Duration*: length of exercise session

(4) *Frequency*: number of sessions per day or week

(5) *Progression*: gradual increases in workload to promote a training adaptation

The individualized exercise prescription should take into consideration the following concepts:

(a) *Overload*. To create a training effect, the exercise performed must exceed the load the individual normally experiences.

Excessive overload can lead to training injuries; therefore, it is best to underestimate workload and err on the side of safety.

Site #1

Site #2

Site #3

percent of body fat

Member's weight divided by height² =

. 20 – 24.9 kg/m²

. 25 – 29.9 kg/m²

. 30 – 34.9 kg/m²

. over 35 kg/m²

Waist circumference

Hip circumference

Waist-to-hip ratio =

Body density

Body density

Mode of Testing Results

Muscular Endurance

. Push-up test [60 sec (max)]

. Other

. Sit-up test [60 sec (max)]

. Other

Maximal number of push-ups performed consecutively without resting

Maximal number of sit-ups performed within 1 minute

Body Composition Testing

Skinfold assessment

Body mass index

Waist-to-hip ratio

Hydrostatic weighing

Bioimpedance (BIA)

(b) *Progression*. As adaptations to the load take place, the load must be progressively increased in order to continue adaptations and improvements. Programs should progress gradually to avoid overtraining and injuries.

(c) *Specificity*. Overload training leads to adaptations in the muscles and stresses physiological systems. The adaptations are specific to the manner in which the person trains. This principle of training will be very important for individuals who need to target a specific aspect of fitness.

(d) *Targeting the Improvement of Health and Fitness*. Programs designed to improve health will not necessarily improve fitness. However, any properly designed exercise training program designed to improve fitness will also have a positive impact on overall health. The *1996 Surgeon General's Report on Physical Activity and Health* states that physical activity need not be strenuous to improve health, although greater health and fitness benefits can be achieved by increasing the amount of physical activity. Since a high level of physical fitness is essential for safely performing fire-fighting duties, a fitness program designed for public safety personnel should promote health and a higher level of physical fitness. The workout regimen should include exercises to improve aerobic capacity and muscular fitness components (i.e., strength, endurance, flexibility).

B.3 Warm-Up and Cool-Down Exercise.

B.3.1 Pre-Exercise (Warm-Up). Each workout session should include at least a 5- to 10-minute warm-up period. The purpose of the warm-up is to increase body temperature while improving the flow of blood and oxygen to the muscles. A warm-up prepares the body for the more strenuous exercise to follow, decreases risk of injury, and improves performance.

B.3.2 Post-Exercise (Cool-Down). A 10- to 15-minute cooldown period should follow each workout. This period includes a gradual tapering of exercise intensity followed by stretching. The purpose of the cool-down is to assist in the return of blood to the heart, thereby reducing cardiac stress. Tapering should be followed by stretching of the affected muscles to promote flexibility and reduce muscle soreness.

B.4 Aerobic Fitness.

B.4.1 Significance. Aerobic exercise has many benefits, including increased aerobic capacity, muscular endurance, improved bone density, and improved body composition. The *1996 Surgeon General's Report on Physical Activity and Health* found that inactivity is hazardous to health. Aerobic exercise

generally reduces coronary risk factors, muscle fatigue, injuries, and morbidity. Repeatedly, research has shown the need for fire fighters to have high levels of aerobic fitness in order to perform their job.—

B.4.5 Duration. The duration of the workout can be determined by time, distance, or calories expended. Exercise duration is integrally related to exercise intensity, and together they determine the total number of calories burned in an exercise session. Total caloric expenditure can also be used to help determine exercise intensity and duration.

The ACSM recommends 20 to 60 minutes of continuous activity, excluding the warm-up and cool-down period. Unfit individuals can benefit from multiple sessions of less than 10 minutes until they are able to withstand training of a longer duration.

B.4.6 Frequency. Exercise frequency is related to the intensity and duration of the exercise program as well as to individual time constraints and goals. Persons with very low fitness levels will benefit from multiple workouts per day, because they have to exercise at a low intensity and short duration due to lack of fitness. Two to three short workouts per day could be most appropriate. The ACSM recommends a minimum of three aerobic workouts per week to improve fitness and two sessions per week to maintain current fitness levels. Workouts should be performed on nonconsecutive days in order to allow adequate recovery between sessions. Weight training exercises can be performed on the days following the aerobic workout.

B.4.7 Weekly Caloric Expenditure. One goal of an exercise program can be a reduction in body fat. The total weekly caloric expenditure, which is determined by exercise intensity, duration, frequency, and mode, can also be used as a tool to determine the exercise prescription. The ACSM recommends a minimal caloric expenditure of 300 calories per exercise session performed three times a week or 200 calories per session performed four times a week. The *1996 Surgeon General's Report* recommends an accumulated exercise expenditure of 1000 calories per week to improve health. A more optimal level to improve performance is an expenditure of 2000 calories a week.

B.4.8 Rate of Progression. According to the ACSM, the following considerations should be made when determining the proper rate of progression for an individual:

- (1) Medical, health, and coronary risk status
- (2) Functional capacity
- (3) Musculoskeletal conditions
- (4) Age
- (5) Individual goals and preferences
- (6) Specificity to occupational demands

Progressions can come in the form of increases in intensity, duration, and frequency, or a change in mode of exercise (e.g., running instead of cycling). Progressions should be gradual to avoid training injuries.

B.5 Muscle Fitness.

B.5.1 Significance. Components of muscle fitness include muscular strength, endurance, and flexibility. The demands of fire fighting require an above-average level of muscular strength and endurance. Increases in bone, muscle, and connective tissue strength and density decrease the risk of soft tissue injuries. Fire fighters have to be able to pull, drag, and carry heavy loads.

B.5.3.2 Exercise Selection. A combination of all of the modes of training described in B.5.3 can be the most beneficial, especially for a fire fighter who needs to train specifically for job tasks but who also desires a safe and convenient exercise program. Regardless of what mode of training is used, a program should be balanced and complete. A minimum of one exercise should be included for each of the following movements:

- (1) Upper-body push
- (2) Upper-body pull
- (3) Lower-body thrust and extension using the hip and knee joint
- (4) Knee flexion (hamstrings)
- (5) Anterior trunk (abdominal)
- (6) Posterior trunk (lower back)

B.5.3.3 Intensity. Using the principle of repetition maximal (RM), the weight or resistance should be such that at least 5 repetitions can be completed, but no more than 20 repetitions can be performed, with a given weight (5–20 RM). Exceptions would occur during warm-up sets and sets performed by novice lifters, as well as returning from an injury or individuals with a low fitness level. These types of sets can be performed with lighter loads that would allow more repetitions as follows:

- (a) To emphasize the development of strength, a weight

that allows 5 to 8 repetitions, or is a 5–8-RM load, should be used. Complete 3 to 6 sets of each exercise.

(b) To emphasize the development of muscular endurance, a weight that allows a minimum of 10 repetitions, or a 10-RM load, should be used. Complete 3 to 6 sets of each exercise.

(c) To emphasize proper warm-up, a light weight that allows 8 to 10 repetitions should be used. Complete 1 to 2 warm-up sets for each exercise.

B.5.3.4 Duration. The total volume of training (i.e., number of exercises, repetitions, and sets completed) should determine exercise duration, which can last from 20 to 90 minutes. The mode of training can also be a factor in determining duration. Circuit training and the use of weight machines can provide a faster workout.

B.5.3.5 Rest Interval Between Workouts. A minimum of 48 hours between workouts of the same muscle should be allowed. Exceptions include the forearms, calf, and abdominal muscles, which can be exercised more frequently.

B.5.3.6 Rest Interval Between Sets and Exercises. More rest between sets and exercises is needed at the beginning of a program, after an injury, during a multijoint lift (e.g., squat), or when lifting heavier weights to emphasize strength. The following guidelines can be used to determine rest intervals between sets and exercises:

- (1) *Strength*: 2 to 3 minutes of rest between sets and exercises
- (2) *Endurance*: 30 seconds to 2 minutes of rest between sets
- (3) *Circuit program*: 15 to 30 seconds of rest between exercises

B.5.3.7 Training Frequency. The ACSM recommends that a minimum of 2 days per week be devoted to muscular fitness training. According to NSCA, improvements can be achieved at a frequency of 2 days per week, but 3 alternating days per week is superior to other training frequencies. Generally speaking, persons who are in good health, have a good training background, and desire muscular endurance and hypertrophy should engage in more frequent training. Persons of questionable health, limited training background, or engaging in heavy training using multijoint exercises designed to increase strength and high-intensity power should train less frequently. Two or more training sessions a week are required to maintain or make gains. The frequency of training depends on all of the following factors:

- (1) Initial level of conditioning
- (2) Individual goals

- (3) Health status of the athlete
- (4) Volume and load of exercises
- (5) Type of movement performed (multijoint vs. single-joint)

B.5.3.8 Rate of Progression. All exercise programs should start gradually in order to ease through the initial stages of the body's adaptation to the stress of exercise. Resistance training is no exception, as it follows the same stages described in the aerobic training section. (*See Section B.4.8.*) However, the method of increasing the workout will include one or several of the following factors:

- (1) Increased resistance (weight)
- (2) Increased repetitions
- (3) Increased sets
- (4) Decreased rest interval between sets
- (5) Increased frequency of training
- (6) Change in exercises or training mode

B.6 Flexibility.

B.6.1 Significance. Flexibility measures the range of motion in a joint, which depends on the extensibility of soft tissues (i.e., muscles, tendons, ligaments). Lack of flexibility can hinder physical performance or contribute to an increased risk of injury. Benefits of stretching include the following:

- (1) Relaxation from stress and tension
- (2) Improved circulation
- (3) Relief of lower back pain
- (4) Relief of muscle soreness
- (5) Improved coordination
- (6) Improved job performance
- (7) Reduced risk of injury

B.6.3 Flexibility Exercise Prescription.

B.6.3.1 Mode. The static stretching technique is safe and effective and is therefore the recommended method of improving flexibility. If personnel trained in the PNF method of training are available, stretching can be even more effective. To stretch the muscle statically and slowly, the muscle should be stretched to a point of tension, not pain, and held for at least 10 seconds. After the initial 10 seconds, the stretch should be lengthened a little further, and held another 10 seconds or longer. Each stretch should be repeated two to three times.

B.6.3.2 Intensity. Individuals should stretch to the point of tension, not pain. No pain, no gain definitely does not apply here. The stretch should be felt in the belly of the muscle and

not at the joint.

B.6.3.3 Duration. Each stretch should be held at least 10 seconds, then progressed to 30 seconds or longer. Completing a stretching program for the whole body will take approximately 10 to 15 minutes.

B.6.3.4 Frequency. Stretching can and should be done daily. After the initial warm-up, stretching exercises will prepare the body for the more strenuous workout to follow. Stretching after a workout improves flexibility and decreases muscle soreness. A minimum of three stretching workouts a week will generally improve flexibility.

B.6.3.5 Progression. To progress in the flexibility program, increases should be made in the duration of the stretch to more than 10 seconds, in the number of repetitions (up to five repetitions), or in the frequency of stretching. Flexibility can be maintained by stretching at least three times a week, especially before and after workouts. Conducting weight training activities using a full range of motion in each exercise will also help maintain flexibility.

B.6.3.6 Stretching Tips. The following tips can be helpful in making stretching safe and effective.

- (1) Always warm up muscles with an activity that elevates heart rate and muscle temperature before stretching.
- (2) Cold muscles should not be stretched.
- (3) The breath should not be held while stretching. Relaxing and slow breathing should be encouraged.
- (4) Proper technique and posture/body alignment should be used when stretching.
- (5) Stretching a muscle should be discontinued if a dull ache or burning sensation that could indicate a tissue tear is experienced.

B.7 Healthy Back Exercise Program.

B.7.1 Significance. Approximately 5 million Americans suffer from acute or chronic back pain, which accounts for over 90 million lost production days annually. A recent report by M. Karter in the *NFPA Journal* found that lower back sprains and strains were the most common type of injury. The physical demands placed on fire fighters puts them at great risk especially if they are not adequately conditioned.

The following are common causes of lower back pain and injury:

- (1) Weak abdominal and/or lower back muscles
- (2) Inflexible lower back, hamstrings, and hip flexor

(3) Improper posture and body mechanics

B.7.2 Mode. Strengthening and stretching exercises, and exercises that improve aerobic fitness to lessen or prevent fatigue, are general prescriptions in a healthy back exercise program. Specific exercises to strengthen the lower back, abdominal region, and the muscles in the trunk region are essential. The trunk region is often the weakest link in the body. It is responsible for transferring muscle forces from upper body to lower body, and vice versa, as well as for stabilizing and controlling movements of the spinal column. If lower back pain is consistent or severe, exercising should be discontinued, and the member should be examined by a physician.

B.7.3 Intensity. All exercises should be carried out at a low to moderate intensity. Proper form, not high intensity, should be emphasized. Each exercise should be completed in a slow, controlled manner. All stretching should follow the prescription for static stretching.

B.7.4 Duration. Exercise should continue for 10 to 20 minutes, depending on the number of exercises and stretches.

B.7.5 Frequency. Healthy back exercises should be carried out three to five times a week. As mentioned previously, these exercises can be inserted into any warm-up routine.

B.7.6 Progression. Stretches can be progressed by holding longer and gradually stretching further. Calisthenics and trunk strengthening exercises can be increased by completing more repetitions, or sets, or by adding light weights. The frequency of training can also be increased. Ten minutes of stretching and trunk strengthening exercises three times a week will maintain levels; thirty minutes a week to lessen the risk of a back injury is an excellent time investment. Cardiovascular and weight training exercises will also contribute to maintenance of a healthy back.

B.7.7 Improper Body Mechanics. Improper posture or lifting mechanics are often the result of weak and inflexible muscles. Strengthening the trunk region and improving flexibility will improve body mechanics.

Virtually all lifting tasks involve the legs; therefore, the legs should be strengthened. However, it is crucial for a fire fighter to employ proper lifting techniques even when the load is relatively light. Lifting free weights can help in learning how to lift properly, but specific lifting procedures should be followed for various fireground tasks. The feet should be approximately

shoulder width apart, legs bent at the hips and knees, lower back flat or slightly bowed inward, chest and buttocks out, head erect. The power to lift should come from the legs and lower trunk, not the upper body.

B.7.8 Using Weight Belts. Recommendations for strength training involving the use of weight belts are as follows.

- (1) For exercises not stressing the back, a belt should not be worn.
- (2) For exercises directly stressing the back, a belt should not be worn during lighter sets but always worn for near maximal and maximal sets.
- (3) It should never be assumed that a weight belt will afford protection against improper lifting technique.

B.8 Safety and Injury Prevention. The following are general guidelines for prevention of injuries while exercising.

- (a) Warm-up and stretching exercises should be performed before a workout. The exercise intensity and stretch should be gradually tapered after a workout.
- (b) Members should not overestimate their abilities when beginning an exercise program. Starting out slow and easy and gradually increasing the exercise intensity, duration, or frequency is paramount. Members need to remember that they do not get out of shape overnight and that they cannot get into shape overnight. They need to be patient.
- (c) Chronic muscle soreness and fatigue are signs of overtraining. They indicate the need to reduce the workout stimulus, to increase the recovery period between workouts, or both. The body's messages should be heeded.
- (d) Properly fitting exercise equipment and clothing should always be worn.
- (e) Performing the same workout routine should be avoided. Variety not only reduces boredom but also avoids overuse-type injuries. Periodically changing the modes of exercise, the intensity, and the duration of workouts is required. Changing the exercise stimulus also issues a new challenge to the body, resulting in continued improvements.